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'1'@/Model Correlation for Mars Pathfinder Multi-Body System Drop Tests

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ABSTRACT

Introduction

Mars Pathfinder is a \$150 million unmanned Mars exploration mission designed to deliver a lander, camera anti instrument-laden rover to the Martian surface! on July 4, 1997. To meet the mission requirements, a passive 1 entry, 1 Descent, and Landing (EDL) approach has been developed and simulated by an end-to-end Monte Carlo simulation. A critical concern is the validity of the dynamic model used in the simulation for predicting the dynamical behavior of the system as it descends through the Martian atmosphere. To address this concern, a series of multi-body system drop tests was performed and followed by an extensive test/model correlation effort. This paper summarizes the successful correlation of the test results to the test n-model.

General Approach

A 3-1) multi-body dynamic model, as illustrated in Figure 1, was developed based on the test configuration. This test model consists of a disk gap-band parachute, backshell, bridle and lander. The modal parameters of the test model were obtained by linearizing the test model. Spectral analyses were performed to extract out the corresponding modal parameters from the test data. The model parameters were updated by correlating these two sets of modal parameters. An extensive parametric study was performed to identify the parachute aerodynamic coefficients using the view angles digitized from the video taken during the multi-body system drop tests,

Results & Conclusions

As summarized in "Table 1, the test/model correlation results validated many important assumptions and parameters, including the parachute aerodynamic coefficients, used in the Mars Pathfinder EDL simulation. The test verified model was used to develop a dynamic model for the final end-to-end Monte Carlo EDL simulation. The simulation results will be used for final system performance assessment.